

Draft Statement of Work

Technical Support for Assessment of the Fate and Transport of Pesticides in the Environment

I. BACKGROUND

EPA's Office of Pesticide Programs (OPP) as required by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Federal Food, Drug and Cosmetic Act (FFDCA) as amended by the Food Quality Protection Act (FQPA) of 1996, is responsible for the regulation of pesticides through the registration, registration review and reregistration of pesticides. OPP develops data requirements and guidelines for the conduct of studies by registrants that are used, along with other data and information, to assess the potential impact of the use of the pesticide on human health and the environment. Before EPA can use studies and data in assessing risk, these data must be evaluated to determine their adequacy and validity and to ensure that appropriate quality assurance procedures were carried out. Once data have been evaluated and determined to be acceptable and valid, these data are used to assess risk to human health and ecological resources. OPP also convenes scientific workshops and seminars to discuss and resolve scientific issues associated with the registration, registration review and reregistration of pesticides.

This procurement will provide support primarily in the area of review and evaluation of available data pertaining to the chemistry and fate of pesticides in the environment (including the evaluation of environmental monitoring data), assessing environmental risk from pesticides, and the assessment of pesticide fate and transport in the environment. This procurement will also provide occasional support to EPA in the researching of pesticide fate and transport science policy issues and the development of science policy options for evaluation and consideration by EPA.

The Contractor shall upon request by EPA, collect data from the open literature or from other sources designated by EPA and shall review these data as well as all other fate and transport studies provided to the Contractor by EPA. The reviews shall: (1) evaluate individual studies of environmental fate processes and will identify any variance from published guidelines/standard evaluation practices/data review guidelines, etc., (2) evaluate environmental monitoring data and characterize the nature and extent of measured contamination, and, (3) evaluate data from the open literature when specifically requested by EPA. The data requirements to support registration or reregistration are delineated in 40 CFR part 158, Guidelines for Registering Pesticides in the United States 1982, Subpart N and other applicable documents.

Fate and risk assessments completed by the Contractor shall use valid and adequate data, including valid data and studies retrieved from the open literature, as well as any fate and transport assessment documents provided by registrants or other governmental bodies and present a detailed summary of the fate and transport properties and/or risk of the pesticide in the environment and a synthesized characterization of the fate and transport properties of the pesticide. These assessments shall follow OPP guidance on the content and format of fate and transport assessments (see attached example for the compound propachlor in Appendix C). The EPA will use the resulting information on the validity of studies and data and the assessments of the pesticide's fate and transport properties, and risk in its risk characterizations that will then be used in making regulatory decisions.

Environmental Fate and Evaluation Division (EFED) will make available to the Contractor the data, studies, and information which is to be reviewed, with the occasional exceptional circumstance where the Project Officer requests the Contractor collect and aggregate extant environmental monitoring data or fate and transport studies from the open literature. The studies and data will be provided in printed form (originals or reprints of each study) and/or electronic form. Due dates for each data package and/or assessment and/or project shall be negotiated between the Project Officer (Agency) and the Project Manager (the Contractor). The Contractor shall receive the final data package and/or assignment to complete an assessment or project no later than two months prior to the end of the contract Period of Performance.

This contract shall require the Contractor to research, evaluate and analyze data and information pertaining to the chemistry and fate of pesticides in the environment and measurements of pesticides in the environment and to complete, assessments that describe the fate and transport properties of the pesticide as well as other areas as specified in the Statement of Work. It may require the Contractor, on occasion, to conduct research to understand science issues, hold scientific workshops, conduct analyses of issues and provide science policy options. The foregoing is not an exhaustive list of the situations contemplated by the Statement of Work. The Contractor shall fully substantiate and document all work efforts in this regard so that EPA may critically analyze and approve/disapprove any recommendation, options, alternatives or courses of action flowing from the Contractor's work effort.

II. GENERAL REQUIREMENTS

A. FIFRA CBI

To perform Work Assignments under this contract, the contractor may require access to FIFRA Confidential Business Information (FIFRA CBI) submitted by pesticide registrants to EPA. Disclosure of FIFRA CBI to contractors is provided for under

Section 10(e) of FIFRA and in 40 CFR 2.307. Consequently, the contractor must be cleared for access to FIFRA CBI and must control FIFRA CBI according to the requirements specified for contractors in the EPA publication, "FIFRA Information Security Manual", dated July 1988. Access of the contractor to FIFRA CBI is intermittent and will not require allocation of office space. If contractor works on-site, identification of contractor personnel will be verified by EPA.

Control measures for protecting FIFRA CBI shall be in accord with the following sections of the Security Manual:

- Disclosure of FIFRA CBI to contractors (section 3)
- Procedures for gaining access to FIFRA sensitive information (section 4) and
- Operational procedures for protecting FIFRA sensitive information (section 5).

The contract as written shall incorporate certain clauses that describe actions to be taken by the contractor with regard to FIFRA sensitive information; these clauses are contained in 40 CFR 2.301 (h)(23)(ii), and are Exhibit 6 in the Security Manual.

B. Other General Requirements

The Contractor will adhere to the following general requirements.

1. In performing the services required under this SOW, the Contractor shall submit all relevant information used in developing conclusions or options to the cognizant Project Officer (PO) for all projects for evaluation review and approval.
2. All reports, drafts, papers, etc., prepared by the Contractor shall be submitted in draft paper form and in electronic form on a CD or other media identified by the EPA Program Office in a current version of WordPerfect or compatible software. It is possible the standard word processing software may change, in which case the Contractor will be notified in advance and allowed time to adjust their operating systems. The Contractor shall submit the completed draft to the cognizant Program Office for review and approval. The drafts submitted shall include copies of the literature cited or make reference to all citation in the document for Program Office verification and approval.
3. When in attendance at meetings, the Contractor's attendance shall be limited that portion of the activity for which the Contractor is required in order to meet the requirements of the SOW. The Contractor personnel shall identify himself or herself as contractor personnel in all activities associated with work performed under the SOW, and in attendance at meetings in conjunction with activities associated with the SOW requirements.

4. Reports submitted by the Contractor that contain recommendations to the Agency (which will be used by EPA personnel developing policy), shall explain and rank policy or action alternatives, summarize the substance of deliberation; report any dissenting views; list the sources relied upon; and make clear the method and consideration upon which the recommendations are based.

5. The Contractor shall develop internal policies and procedures for ensuring that the Contractor's reviewers properly evaluate the fate and transport data and complete quality fate and transport, and other required assessments. The Contractor shall institute Contractor staff training programs and shall submit copies of all internal policies, operating procedures, and training programs to the Agency within 2 months of the awarding of this contract.

6. The Contractor must communicate by telephone with the PO at least every other week to discuss the progress of the tasks.

7. Unless other specified in this contract, the Contractor shall not engage in nor subcontract for, any printing (as the term is defined in the Title I of the Government Printing and Binding Regulations in effect on the effective date of this contract) in connection with the performance of work under this contract. Printing is allowed for less than 5,000 units of only one page and less than 25,000 units in the aggregate of multiple pages. Pages not exceeding 10 and 3/4 inches by 14 and 1/4 inches in size will not be considered printing.

8. Contractor must adhere to all the provisions stated in EPAAR 1552.209-71 "Organizational Conflict of Interest," EPAAR 1552.209-73 "Notification of Conflicts of Interest Regarding Personnel," EPAAR 1552.210-80 "Annual Certification," EPAAR 1552-210-81 "Update of Conflict of Interest Plan," and EPAAR 1552.227-76 "Project Employee Confidentiality Agreement." The RFP and contract will contain Conflict of Interest (COI) provisions and clauses to allow the Agency to avoid actual or potential conflicts of interest. These provisions will require (1) offerors to submit conflict of interest avoidance plans as part of these proposals, and (2) the contractor to alert EPA to actual or potential conflicts of interest with respect to individual work assignments.

9. Any training aid, database, checklist or other system or shell, whether in electronic or in hard copy, that is developed by the Contractor in the process of performing the tasks under this contract, and the development of which is charged to the EPA Program Office, shall be made accessible to the EPA Program Office at the request of the Program Office, and will be the property of the EPA Program Office.

C. Enhanced Review

Under Section 33 of FIFRA (as added by subsection (f)(2) of the Pesticide Registration Improvement Act of 2003), the Agency will collect fees from registrants to

register their pesticide chemical for review. The benefit of this Fee is to guarantee the registrant that the time frame for registering their chemical will be reduced.

This contract shall require the contractor, on occasion, to perform an enhanced review of some pesticide chemicals, regardless of the current workload. The contractor shall receive a separate work assignment for this type of review which will be processed as a Performance-Based work assignment. This work will be funded with new appropriated funds associated with the Act. Along with the enhanced review of the pesticide chemical, the contractor shall also be required to track the hours and dollars associated with this work assignment separately. As in a Performance-Based task, the contractor shall receive an incentive dependent upon the percentage of work that is completed by the requested due date, and a disincentive if the task is not complete by the requested time allowed.

III. SCOPE OF WORK

The contractor shall supply the necessary labor, materials, equipment, services and facilities required for the performance of each work assignment. The scientific quality of reviews, assessments and reports and their timely preparation in accordance with negotiated schedules are of paramount importance in the performance of this contract. Consequently, the contractor shall have the necessary technical and scientific expertise and knowledge and experience to work effectively from contract start-up throughout the course of the contract. In addition, the contractor shall have a quality assurance/quality control program that maintains the quality of products as well as an ongoing training program to ensure that contractor staff responsible for data evaluation, fate and transport assessments, and the evaluation of science policy produce quality products and that feedback from OPP on needed improvements reaches the Contractor's staff. Performance of work under this contract shall be initiated by Work Assignments issued by the Contracting Officer, and will encompass tasks in one or more of the following areas: literature searches and collecting of data and studies, fate and transport data evaluation, assessment of pesticide fate and transport, evaluation of environmental monitoring data, assessments and characterization of environmental monitoring data (including surface water, groundwater, and drinking water data), identification of fate and transport science policy issues and options, and the convening of workshops and scientific meetings to discuss science policy options in the fate and transport of pesticides.

IV. TASKS

1. **Literature searches and collection of extant monitoring data from designated data bases and/or other sources.**

The Contractor shall, upon request by EPA, perform targeted searches of the open literature and designated data bases and/or other sources for information,

studies, and data pertaining to the fate and transport properties of pesticides. Retrieval of paper copies of citations generated from literature searches or from lists provided by EPA.

2. Review and evaluation of fate and transport studies from the open literature.

The Contractor shall perform critical reviews of EPA designated fate and transport studies from the open literature, and these reviews will be provided to the EFED Project Officer. Each review will encompass all items in the study that contribute to the overall knowledge of the pesticide, and will include the following:

- 1) An evaluation of the accuracy, credibility and scientific validity of that study.
- 2) Its suitability for meeting data requirements.
- 3) Any necessary graphic displays of data, and/or summary tables necessary to allow one to reach an independent conclusion about the results of the study.

These reviews will be sufficiently complete in description and technical data to stand on their own as a source of information for use in EFED's exposure assessment.

In all cases where part or all of a study is considered to be unacceptable because of a variance from the guidelines or on technical or scientific grounds (reliability or completeness), the Contractor will explain the specific reasons for making such a conclusion.

3. Review and Evaluation of Individual Fate and Transport Studies (See also Appendix B)

The Contractor shall perform critical reviews of each study/protocol furnished to them, and these reviews will be provided to the EFED Project Officer. Each review will encompass all items in the study that contribute to the overall knowledge of the pesticide, and will include the following:

- 1) An evaluation of the accuracy, credibility and scientific credibility of that study.
- 2) Its suitability for meeting data requirements.
- 3) Any necessary graphic displays of data, and/or summary tables necessary to allow one to reach an independent conclusion about the results of the study.

These reviews will be sufficiently complete in description and technical data to

stand on their own as a source of information for use in EFED's exposure assessment. Periodically, the Contractor shall be asked to screen studies and data-sets. That is, perform an abbreviated review of studies, and/or the overall data-set to determine if there is sufficient information, to determine if they are adequate for a critical review, and to relate the ability of the data-set to meet the data requirements as identified by EFED.

In all cases where part or all of a study is considered to be unacceptable because of a variance from the guidelines or on technical or scientific grounds (reliability or completeness), the Contractor shall explain the specific reasons for making such a conclusion.

4. Summary of Pesticide Fate and Transport in the Environment

When requested by the Project Officer, the Contractor shall compile reviews of valid data on the fate and transport properties of a pesticide and provide a detailed summary/assessment of the pesticide's fate and transport properties and provide these assessments to EPA's Project Officer in accordance with negotiated schedules. The assessments will address all the key parameters of the pesticide's behavior in the environment. The assessments will answer basic questions such as where and how the pesticide moves in the environment and how long it will persist, what degradation products are produced and in what quantities, how much of the pesticide or toxicologically important degradates are likely to reach groundwater and/or surface water, what types of water treatment will likely remove the pesticide from drinking water and what are the major routes of dissipation in the environment. Completing these assessments may involve the collection and/or aggregation and review of extant water monitoring data from such publically available sources as the USGS, STORET, and the NCOD and the use of OPP predictive models and modeling scenarios. On occasion, the contractor may be asked to develop a new modeling scenario in order to complete an assessment. The assessments will meet OPP requirements in terms of content, format, and methodologies (see Appendix C).

5. Review and evaluation of extant environmental monitoring data, with a particular emphasis on water monitoring data (i.e., groundwater, surface water and drinking water).

The Contractor shall review extant environmental monitoring data and shall evaluate the quality and reliability of the data for use in risk assessments. These reviews shall be provided to the EPA Project Officer and shall include:

- 1) A critical evaluation of the quality of the monitoring data, the reliability of the measurements, and the representativeness of the measurements with respect to vulnerability of the area to contamination. That is, the Contractor shall review the data, investigate how the samples were selected, where they were taken,

why they were taken and how they were analyzed and provide to EPA its assessment of the quality, reliability and representativeness of the measurements.

6. Assessments and characterizations of environmental monitoring data results.

The Contractor shall, upon request by EPA, assess and characterize the nature and magnitude of environmental contamination based on the reviews of environmental monitoring data. These assessments shall include ranges of valid measurements, measures of central tendency (e.g., median and average concentrations), 99.9% values and 95% values, and may involve (at the request of EPA) the conduct of meta analyses of divergent data sets and the estimation of the distribution of measurements and the number of people exposed to different levels of contamination. Completing these assessments may involve the collection and/or aggregation and review of extant water monitoring data from such publically available sources as the USGS, STORET, the NCOD and state data bases.

7. Evaluation of fate and transport science policy issues, including the convening of scientific workshops, and the development of science policy option papers.

Occasionally, when requested by the Project Officer, and in accordance with negotiated schedules, the Contractor shall investigate issues of science policy in the field of the environmental fate and transport of chemicals. The Contractor shall develop reports which define the science policy issue, identify science policy options, evaluate the options and the implications of options, convene scientific workshops to understand the full range of perspectives on the issue and the full range of options, and develop science policy option papers presenting the results of the evaluation and workshops. In the convening of scientific workshops, the Contractor shall convene recognized national experts in the science policy area under review and shall provide appropriate technical facilitation, technical note taking and the development of proceedings documents capturing the dialogue and the conclusions of the workshops.

Reports submitted by the Contractor that contain recommendations to the Agency (which will be used by EPA personnel developing policy), will explain and rank policy or action alternatives, if any; describe the procedures used to arrive at recommendation, summarize the substance of deliberation; report any dissenting views' list the sources relied upon, and makes clear the methods and consideration upon which the recommendations are based.

8. Entry of data/information into OPP-provided databases.

Upon request of the Agency the Contractor shall input data or information into established OPP databases with designed fields for such information.

APPENDIX A

Major areas to be considered for specific studies is as follows:

A) Hydrolysis – data requirement 161-1

- (1) Half-lives (T_{1/2}) under defined conditions
- (2) pH effect(s)
- (3) Temperature
- (4) Media effect – e.g., potential buffer effects by PO₄⁻³ ion
- (5) Identification and quantification of degradates
- (6) Testing conditions
- (7) Sterilization
- (8) Material balance
- (9) Formation and decline patterns of degradates
- (10) Consistency of results with other relevant environmental fate studies (e.g., aqueous photolysis).

B) Photolysis – data requirements 161-2 (aqueous solution), 161-3 (soil), 161-4 (air)

- (1) Identification and quantification of degradates
- (2) Rate of photodegradation (degradation rates should be corrected for degradation in dark control)
- (3) Complete description of experimental parameters including complete comparison of light sources with natural sunlight including intensity and spectral characteristics; standardization techniques (actinometry); solvent system; pH; photosensitizers; film thicknesses, etc.
- (4) For soil photodegradation, the type of soil, method of preparation, and technique of application of the test material.
- (5) Sterilization (in the aqueous study).
- (6) Material balance.
- (7) Formation and decline patterns of degradates
- (8) Buffer solution properties should be appropriate in aqueous studies (Solution pH should be condition with none or minimal abiotic hydrolysis)
- (9) Consistency of results with other relevant environmental fate studies (e.g. are dark control results of the aqueous and soil photolysis studies consistent with hydrolysis and aerobic soil metabolism studies, respectively).

C) Metabolism

- (1) Soil
 - (a) Aerobic – data requirement 162-1
- [1] Identification and quantification of degradates/metabolites including soil bound residues and CO₂.
- [2] Calculation of the half-life of the pesticide and

- patterns of formation and decline of its degradates under defined conditions. Calculation of initial and subsequent half-lives if the reaction is biphasic.
- [3] Discussion of factors which could limit or enhance aerobic degradation, such as microbial population, pH, temperature, etc., where applicable.
 - [4] The tendency of the pesticide or its degradation products to bind to soil.
 - [5] Details of soil characteristics including soil series name, soil preparation, and method of application of test material.
 - [6] The tendency of the compound to completely degrade to soil bound residue and CO₂ versus its tendency to persist and accumulate.
 - [7] The overall pattern of decline of degradates, as well as the formation and decline of degradates, as well as the maximum concentrations reached by the degradates. If the decline is not linear, details shall be provided.
 - [8] Material balance.
 - [9] Evidence that microbial activity was maintained after pesticide application and throughout the study.

(b) Anaerobic – data requirement 162-2

- [1] as (a) [1] above
- [2] as (a) [2] above
- [3] Discussion of factors which could limit or enhance anaerobic degradation, such as pH, temperature, redox conditions resulting from anaerobicity, etc.
- [4] as (a) [4] above
- [5] as (a) [5] above
- [6] Method of achieving and maintaining anaerobic conditions.
- [7] The overall pattern of decline of percent compound and formation and decline of degradates, as well as the maximum concentrations reached by the degradates. If the decline is not linear, details shall be provided.
- [8] Material balance.

(2) Aquatic Metabolism, (a) Anaerobic – data requirement 162-3

- [1] Identification of degradates.
- [2] Calculation of the overall half-life of the parent compound as well as the half life in the water and sediment phases and patterns of formation and decline of its degradates under defined conditions.
- [3] Discussion of factors which limit or enhance anaerobic degradation, such as pH, temperature, etc., where

- applicable.
- [4] The tendency of the pesticide or its degradate to bind to suspended organic matter and/or sediment, versus its tendency to remain in the aqueous phase.
- [5] Details of water and sediment characteristics and preparation, and method of application of test material.
- [6] Method of achieving and maintaining anaerobic conditions where applicable.
- [7] Material balance.
- [8] All information required for anaerobic soil metabolism
- [9] Physicochemical properties of the test water and sediment (e.g., pH, redox potential)

(b) Aerobic – data requirement 162-4

- [1], [2], [4], [5] as above for an anaerobic metabolism
- [3] Discussion of factors which limit or enhance aerobic degradation (pH, temperature, etc.)
- [6] Material balance.
- [7] Physicochemical properties of the test water and sediment (e.g., pH, redox potential)

D) Mobility, (a) batch equilibrium

(1) Learning/Adsorption/Desorption – data requirement 163-1

(a) batch equilibrium - [EFED strongly prefers this method of mobility assessment]

- [1] Indicate the appropriateness of the Koc model (Linear correlation between OM and Kf should exist); indicate appropriateness of the Freundlich model and simple Kd model [Is the 1/n term in the Freundlich model different from 1?]. Adsorption should also be examined for soil pH, CEC, and clay content.
- [2] Indicate conditions for equilibrium study - time of equilibrium, salt concentration, and incubation time.
- [3] Description of procedures to determine adsorption-desorption coefficients.
- [4] Discussion of adsorption/desorption including Freundlich equations; isotherms; and possible mechanisms of adsorption, where appropriate.
- [5] Indicate material balance; specific analytical methods
- [6] Indicate usual observations (e.g., rapid degradation, sorption to the equilibrium container, etc.)

- [7] Evaluation of calculations of K and KOC presented in the study.

(b) Soil column leaching and Soil TLC –laboratory determination of mobility behavior by soil thin-layer chromatography or soil columns. Note that TLC studies are already submitted, since EFED encourages the use of batch adsorption.

- [1] Evaluate of degradation and mobility of the pesticide during Leaching.
- [2] Include a detailed discussion on the soil properties; soil column preparation; rate of water movement, length of time for column leaching, volume of leachate collected as a function of time, and identification of residues in the leachate.
- [3] Comparison of leaching results with those from adsorption/desorption studies.
- [4] Identification and distribution of pesticide residues In the soil columns.
- [5] indicate material balance of radiolabeled residues.

(2) Volatility – data requirements 163-2 and 163-2

- i. Fluxes of parent from soil, water plants, and other sources, and concentration in air as a function of time and air flow.
- ii. Fluxes of volatile degradates and their fate.
- iii. Time course of volatilization and percentage of the compounds that volatilize compared to initial soil concentration.
- iv. All information described in the aerobic soil metabolism (162-1) and terrestrial field dissipation (164-1) studies.
- v. Consistency of study results with aerobic soil metabolism and soil photodegradation studies.

E) Field Dissipation – data requirements 164-1 and 164-5 – Soil (includes bottom sediment and suspended sediment), water column, forest ecosystem (foliage leaf litter, exposed and litter-covered soil, standing/moving water, pond/stream sediment)

- a) Method description includes field design, site management and cropping practices, site properties, pesticide application date and rate, sampling regimes, sample preparation, analytical methods, analytical QA/QC, statistical determination of half-life.
- b) Pattern of decline need to be established for the parent compound parent compound. Pattern of formation and decline need to be established for the parent and degradates.

c) Dept of leaching of parent and degradates should be established.

d) Weather conditions should be described ... rainfall, irrigation, evapotranspiration should be considered.

e) Indicate unusual observation ... (e.g., poor confirmation of application rate immediately posttreatment.

f) Based on laboratory studies, provide a theoretical fate and transport assessment on the rate and route of pesticide dissipation under actual use conditions.

F) Accumulation Studies – data requirements 165-4 (fish) and 165-5 (aquatic non-target organisms)

(1) Bioaccumulation in fish – data requirement 165-4 (laboratory studies)

a) Description of test fish, including species; size; age; weight; conditions and length of acclimation prior to exposure; behavior and mortality before, during, and after exposure.

b) Test protocol including length of exposure, length of depuration method of application of pesticide.

c) Exposure concentration as related to the predetermined toxic concentration – test concentration should not exceed 1/10 of the 96-hr LC₅₀ of the test species.

d) Water characteristic including pH, dissolved oxygen, pesticide analyses, C1⁻ and other significant ions, hardness, source.

e) Residue analyses for parent and degradates in fish (whole body, viscera, and edible tissue) and water.

(2) Bioaccumulation in aquatic non-target organisms – data requirement 165-5 (Field studies)

a) Rate and method of application of test substance 9which should approximate intended use pattern).

b) Description of test organisms taken to represent bottom middle and surface feeders.

c) Sampling protocol.

d) Results of residue analyses of parent and graduate in organism and water.

G. Environmental monitoring data

(1) aquatic

a) surface water

b) groundwater

c) drinking water

2) terrestrial

H. Droplet size spectrum studies (201-1). These studies are designed to assess the effects of nozzle types and orifice size, operating conditions (e.g. aircraft or tractor speed), adjuvants, formulations, and spray discharge orientations on droplet size is the primary determinant of spray drift potential. Droplet spectrum studies may be carried out in tunnels or during the field evaluation of drift using commercial equipment.

I. Drift field evaluation (202-1). These studies involve the use of commercial equipment to determine the extent of drift expressed as the concentration of a pesticide as a function of distance.

Appendix B details the critical questions which will be addressed in performing such reviews and evaluations.

APPENDIX B

CRITICAL QUESTION TO CONSIDER IN PERFORMING REVIEW AND EVALUATION OF STUDIES

EXPERIMENTAL DESIGN

What are the objectives of the study?

Does the design follow Agency guidelines?

Does it address the questions posed in the guidelines?

Does it simulate the actual use conditions?

Does the design represent the state of the art?

Are there areas which might produce ambiguous results?

Has the sampling program been properly designed?

EXPERIMENTAL PROCEDURES

Were any variations from intended protocol noted, explained, considered in reporting the results?

Were experimental methodologies described in sufficient detail that the study could be reproduced in another laboratory?

RESULTS AND CONCLUSIONS

Does the study meet the requirements of the guidelines?

Were the data presented completely and understandably, in a way which facilitated the evaluation of the study? If not, what else would you need?

Were there any unusual variations in the data? If so, were acceptable? If not, how can the losses be explained?

Were results expressed understandably?

Do results account for known quantities used – was material balance acceptable?

What were the study authors' conclusions?

Were investigators' conclusions supported by the results?

APPENDIX C
CONTENT, FORMAT, AND METHOD
IN COMPLETION OF FATE AND TRANSPORT ASSESSMENT

CONTENT AND FORMAT

The following example of Environmental Fate and Transport Assessment represent the desired content, level of detail, and format for these assessments:

Propachlor

METHODS

Use SCI-GROW for Tier 1 Groundwater
Use GENECC for Tier 1 Surface Water
Use PRZM/EXAMS for Tier 2 Surface Water
Evaluation and characterization of Existing Environmental Monitoring Data (including regional characterization where appropriate) : refer to example provided by EPA.

a. Environmental Fate Assessment

i. Degradation and Metabolism

Propachlor is a soluble molecule (613 ppm in water at 25 C), with an octanol/water partition coefficient of 201, and a vapor pressure of 7.9×10^{-5} mm Hg.

Propachlor was stable in aqueous buffered solution at pH's 5, 7, and 9 in the dark. It did not photodegrade significantly in water when exposed to natural sunlight for 30 days. photolysis in soil does not appear to be an important degradation pathway. In a supplemental soil photolysis study, propachlor degraded faster in the dark control than in the irradiated samples. The differences may have been due to differences in moisture between the irradiated and the dark samples.

Aerobic soil metabolism is the most important degradation route for propachlor. In a study loam soil, propachlor degraded with a fitted half-life ($t_{1/2}$) of approximately 2.7 days, calculated using the Gustafson and Holden (1990)¹ model to fit the data. The data show a biphasic degradation pattern that is not well-represented by a first-order degradation model. The fitted model appears to overestimate the rate of degradation in the initial days, but underestimates long-term degradation. The observed 50% dissipation time (DT_{50}) was 5 days. A single study is not adequate to characterize the aerobic soil metabolism of propachlor. Additional studies would show whether the biphasic pattern is typical for propachlor or is an exception. In addition, the slow degradation noted in the soil photolysis study may suggest that propachlor is more persistent under certain conditions.

Two major degradates were observed. Propachlor oxanilic acid was a maximum average of 33% of the applied at 1 month and remained at 29% after 12 months. Propachlor

¹ Gustafson, D.I., and L.R. Holden. 1990. Nonlinear pesticide dissipation in soil: a new model based on spatial variability. Environ. Sci. Technol. 24:1032-1038.

sulfonic acid was a maximum average of 19% of the applied at 1 month and remained at 14% after 12 months. Other metabolites were identified but comprised <10% of the applied at all test intervals.

Under anaerobic conditions, propachlor degraded slowly from a clay loam sediment : lake water system. The calculated half life under the testing conditions was 4.9 months (146 days). Hydroxypropachlor was the major degradate observed, which increased steadily to a maximum average of 37% of the applied 9 months after treatment.

ii. Mobility

Propachlor and its oxanilic acid and sulfonic acid degradates are very mobile. While the parent degraded relatively quickly under soil metabolism, the degradates appear to be more persistent and may leach substantially under normal conditions.

In a batch equilibrium study, propachlor was observed to be very mobile in four soils tested. Freundlich K_{ads} values ranged from 0.45 to 1.39 (average 1.00); K_{oc} values ranged from 73 to 138 (average 112). For parent propachlor the percent organic carbon (%OC) appears to correlate with the K_{ads} values (R^2 of 0.69).

In a batch equilibrium study, propachlor oxanilic acid was very mobile in four soils tested. The Freundlich K_{ads} values ranged from 0.03 to 0.08 (average 0.05). This degradate is expected to be salt in the environment because it has a very low pKa (between 1.3-1.5). Propachlor sulfonic acid was also very mobile in four soils tested; the Freundlich K_{ads} values ranged from 0.03 to 0.07 (average 0.05). This degradate is also expected to be a salt in the environment because it has a very low pKa (<1).

K_{oc} values were not reported for the degradates because no clear correlation exists between the %OC and the K_{ads} values, suggesting that the K_{oc} model is not valid for these chemicals. The K_{oc} values should not be used for modeling or should be applied with the understanding that mobility of the oxanilic acid and sulfonic acid degradates is not related to the organic matter content of the soil.

iii. Bioaccumulation

The octanol/water partition coefficient of 201 for propachlor predicts a slight potential for bioaccumulation. The laboratory results indicate a low bioaccumulation potential. Maximum bioconcentration factors for propachlor residues in bluegill sunfish were 13X for edible tissues, 71X for nonedible tissues, and 37X for whole fish. Depuration was fast (84% of the accumulated residues were released into water by day

3). The ^{14}C residues contained the cysteine and mercapturic acid conjugates of propachlor.

iv. Field Dissipation

The registrant submitted three Terrestrial Field Dissipation studies, conducted in Janesville, Iowa; York, Nebraska; and Uvalde, Texas. At each of the three locations two plots were treated with Ramrod®4L and Ramrod®20G. The studies were conducted on clayey to sandy loam surface soils (full soil classification was not provided). The dissipation half-lives (DT_{50}) observed for propachlor in the field were of the same order of magnitude as the half-life observed in the aerobic soil metabolism study:

aerobic soil metabolism	$\text{DT}_{50} \sim 5$ days; $t_{1/2} = 2.7$ days
Janesville, Iowa	$\text{DT}_{50} = 1.0\text{-}1.7$ days
York, Nebraska	$\text{DT}_{50} = 5.0\text{-}5.8$ days
Uvalde, Texas	$\text{DT}_{50} = 2.3\text{-}2.8$ days

The range in values in the three field dissipation studies represent differences in the granular and flowable formulation of propachlor. Difference in DT_{50} values between sites were greater than differences between formulations on the same site, suggesting that the site conditions have a greater effect on dissipation than the formulation. Detections of propachlor were largely in the upper 0-6 inch soil layer in all the three sites. Some minor detections in lower soil depths were reported.

The degradates observed in the field at high concentrations were propachlor oxanillic acid, propachlor sulfinylacetic acid, propachlor sulfonic acid, and hydroxypropachlor. Of these degradates, the first three are acids that under normal environmental conditions are negatively charged and have high mobility (as also evidenced in the mobility studies). These degradates leached substantially, especially in the Janesville, Iowa, and Uvalde, Texas sites; the degradates were observed as deep as 36-42 inch soil dept, which is lowest soil dept interval tested. In the York, Nebraska site, the level of leaching was not as extensive as in the other two sites. All the acid metabolites appeared to persist much more than the parent propachlor.

The degradates hydroxypropachlor, a minor degradate in the aerobic soil metabolism study but the major degradate in the anaerobic soil metabolism study, was present at relatively high concentrations in all three study sites; however, it did not persist long, with all detections observed generally on or before day 30 after application. Hydroxypropachlor remained in the upper 0-6 inch soil depth.

Two minor degradates, norchloropropachlor and propachlor methysulfone, were also detected. Only norchloropropachlor reached relatively high levels (average 0.101-0.104 ppm) in the Uvalde, Texas plot only. Norchloropropachlor was largely confined to the upper 0-6 inch soil depth. Propachlor methysulfone, although present at low levels, appeared to be more

persistent and somewhat mobile, with detections through 552 days in Janesville, Iowa; 120 days in York, Nebraska; and 365 days in Uvalde, Texas.

E. Spray Drift

The labels indicate that propachlor may be applied by ground spray boom equipment but not aerially. No propachlor-specific ground spray drift studies were reviewed. The Spray Drift Task Force (SDTF), a consortium of pesticide registrants, has completed and submitted to the Agency a series of studies which are intended to characterize spray drift potential due to various factors, including application methods, application equipment, meteorological conditions, crop geometry, and droplet characteristics. EPA is evaluating these studies, which include ground spray as well as aerial application methods. After its review of the studies, the Agency will determine whether a reassessment of the potential risks from the application of propachlor to nontarget organisms is warranted.

b. Degradation

161-1 Hydrolysis (MRID#42485701)

This study is acceptable and can be used to satisfy the Hydrolysis data requirement. No additional data are required.

[¹⁴C]- Propachlor, at 9.4-10.0 ppm, did not hydrolyze in sterile aqueous pH 5, 7, and 9 buffer solutions that were incubated at 20.0-25.5°C in the dark for 30 days.

162-1 Aerobic Soil Metabolism (MRID# 42962502)

This study is acceptable and can be used to satisfy the Aerobic Soil Metabolism data requirement.

[¹⁴C]-Propachlor, at 6.0 ppm, degraded with a calculated non-linear regression $t_{1/2}$ of 2.7 days, in a sandy loam soil incubated in the dark at 24.0-26.0°C. The observed DT_{50} was 5 days. Propachlor was 94.6-99.6% of the applied immediately posttreatment, 50.1-55.1% of the applied at days 5 posttreatment, and 1.3% of the applied after 365 days incubation. Two major degradates were observed:

[(1-methylethyl) phenylamino] oxoethanesulfonic acid (propachlor sulfonic acid), which increased to maximum average of 33.3% of the applied at 1 month posttreatment, and stayed approximately at that level throughout the rest of the study (it averaged 29.0% of the applied at 12 months).

2-[(1-methylethyl) phenylamino]-2- oxoethanesulfonic acid (propachlor sulfonic acid), which increased to a maximum average of 19.1% of the applied at 1 month; it averaged \geq 12.1% of the applied at all the remaining test interval; at 12 months posttreatment it averaged 14.2% of the applied.

Various minor degradates were observed:

([(1-methylethyl) phenylamino] sulfinyl) acetic acid (propachlor sulfinylacetic), which was observed at low levels all throughout the study, with a maximum average of 6.7% of the applied at 1 month after treatment.

2-hydroxy-N-(1-methylsulfonyl)-N-phenylacetamide (propachlor methylsulfone), which was observed at low levels all throughout the study, with a maximum average of 6.0% of the applied on day 5 after treatment.

N-(1-methylethyl)-2-(methylsulfonyl)-N-phenylacetamide (propachlor methylsulfone), which was observed at low levels all throughout the study, with maximum average of 3.2% of the applied on day 5 after treatment.

N-(1-methylethyl)-N-phenylacetamide (norchloropropachlor), which was observed at low levels all throughout the study (average \leq 1.2% of the applied).

After 12 months of incubation 9.5-10.6% of the applied radioactivity was recovered in the NaOH traps (corresponding to $^{14}\text{CO}_2$). <21.4% of the applied was unextractable radioactivity.

162-2 Anaerobic Soil Metabolism

This study is acceptable and can be used to satisfy the Anaerobic Soil Metabolism data requirement. No additional data are required.

[^{14}C] Propachlor, at 5.9 ppm, degraded slowly, with a registrant-calculated half-life of 146 days (4.9 months) for a lake water-sediment system incubated under anaerobic conditions in the dark at 24-26°C for 12 months. [^{14}C] Propachlor averaged 98.1% of the applied on day 0, it averaged 60.6% of the applied 4 months after treatment, and it averaged 20.2% of the applied 12 months after treatment. The major degradate observed was

2-hydroxy-N-(1-methylethyl)-N-phenylacetamide (propachlor alcohol), which increased steadily to a maximum average of 37.3% of the applied 9 months after treatment.

Several minor degradates were detected sporadically and quantified.

d. Mobility/Leachability

163-1 Mobility - Column Leaching (MRID# 0008754)

This study had been previously reviewed and the portion related to parent propachlor was found to be acceptable. This study provides useful information about the mobility of parent propachlor.

Based on column leaching studies, [^{14}C] -propachlor, at approximately 6 lb a.i./A, was determined to be very mobile (>40% of the applied in leachate) in 30-cm columns of loamy sand, sandy loam, and slit loam soils and mobile (approximately 5% in leachate) in columns of

silty clay loam soil that were leached with 20 inches of water. increasing mobility appeared to be correlated with decreasing soil organic matter.

163-1 Mobility- Batch Equilibrium for Parent Propachlor (MRID# 42485702)

This study is acceptable and can be used to partially satisfy the Mobility data requirement. The study provides information about the mobility of parent propachlor. No additional information about the mobility of parent propachlor are required.

Based on batch equilibrium studies, [¹⁴C] -Propachlor was determined to be very mobile in loamy sand, sandy loam, loam, and silty clay loam soil: solution slurries (1:3) equilibrated K_{oc} values are summarized in the table below:

Table A-1: Adsorption-desorption values for Propachlor.

Soil	%OC	K _{ads}	K _{oc} for adsorption	K _{des}	K _{oc} for Desorption
loamy sand	0.40	0.45	113	4.36	1090
sandy loam	1.79	1.30	73	4.12	230
loam	1.11	1.39	125	5.49	495
silty clay loam	0.61	0.84	138	3.06	502

average	N/A	1.00	112	426	679

163-1 Mobility - Batch Equilibrium for Propachlor Oxanilic Acid (MRID# 4248703)

This study is acceptable and can be used to partially satisfy the Mobility data requirement. The study provides information about the mobility of one major degradate of propachlor, propachlor oxanilic acid. No additional information about the mobility of propachlor oxanilic acid are required.

Based on batch equilibrium studies, [¹⁴C] -Propachlor was determined to be very mobile in loamy sand, sandy loam, loam, and silty clay loam soil: solution slurries (1:3) equilibrated in the dark for 24 hours at 25°C. Freundlich K_{ads} and K_{des} values, and respective K_{oc} values are summarized in the table below:

Table A-1: Adsorption-desorption values for Propachlor.

Soil type	%OC	K _{ads}	K _{oc} for adsorption	K _{des}	K _{oc} for desorption
sand	0.42	0.03	7	1.33	317
sandy loam	1.00	0.06	6	6.24	624
loam	1.11	0.05	5	1.73	156
silty clay loam	2.59	0.07	3	1.23	47

average	N/A	0.05	5	2.63	286

e. Fate of Propachlor and its Degradates in the Field

164-1 Terrestrial Field Dissipation (MRID# 43525101)

This study is acceptable and can be used to satisfy the Terrestrial Field Dissipation data requirement for propachlor. The study provides information about the dissipation of propachlor in three sites (Iowa, Nebraska, Texas). It also provides information about the information and decline of three acid metabolites (propachlor oxanilic acid, propachlor sulfinylacetic acid, and propachlor sulfonic acid) and three neutral metabolites (hydroxypropachlor, norchloropropachlor, and propachlor methylsulfone) of propachlor. No additional information is required.

Janesville, Iowa

Propachlor (Ramrod® 4L and Ramrod® 20G), applied once at 6 lb a.i./A, dissipated with a registrant-calculated DT₅₀ of 1.0-1.7 days and DT₉₀ of 6.8-8.8 days from a bareground plot of loamy sand soil in Janesville, Iowa. In the 0-6 inch soil dept of the plot treated with Ramrod® 4L, propachlor average a maximum of 2.402 ppm on day 3 after application,, 1.729 ppm on day 7, and 0.359 on day 14 after application. In the 0-6 inch soil dept of the plot treated with Ramrod® 20G, propachlor average a maximum of 2.031 ppm on day 0, 1.246 ppm on day 3, and 0.135 ppm on day 14 after application. Propachlor remained in the upper 0-6 inch soil layer.

The degradates monitored in the field were as follows:

Propachlor oxanilic acid, which was a maximum of 0.525 and 0.308 ppm at 14 days after application in the plot treated with Ramrod® 4L and Ramrod® 20G, respectively. This

degradate was observed as deep as 36-42 inch soil dept (the lowest dept interval tested, on day 61 after application) for the plot treated with Ramrod® 4L, and 30-36 inch soil depth (day 61 and 125 after application) for the plot treated with Ramrod® 20G. Detections were reported through day 180 after application.

Propachlor sulfinylacetic acid averaged a maximum of 0.169 and 0.130 ppm at 14 days after application in the plots treated with Ramrod® 4L, and Ramrod® 20G, respectively. This degradate leached as deep as 36-42 inch soil dept, with a detection averaging 0.012 ppm on day 180 after application in the plot treated with Ramrod® 20G. The majority of the detections occurred prior to or on day 61 after application.

Propachlor sulfonic acid average a maximum of 0.230 and 0.150 ppm on day 14 after application in the plot treated with Ramrod® 4L and Ramrod® 20G, respectively. It appears that substantial leaching occurred between the 14 and 21 after application in both plots. On day 21 after application, this degradate average 0.153 and 0.141 ppm in the 6-12 inch soil dept in the plots treated with Ramrod® 4L and Ramrod® 20G, respectively. Detections of propachlor sulfonic acid were reported as deep as 36-42 inch soil depth (the lowest depth interval tested) on day 61 after application in both plots, treated with Ramrod® 4L and Ramrod® 20G. Detections appear to be consistent through day 61 after application for the plot treated with Ramrod® 4L and through day 125 for the plot treated with Ramrod® 20G,

The neutral degradate observed at high concentrations was hydroxypropachlor, which was a maximum of 0.351 and 0.201 ppm on day 3 after application in the plots treated with Ramrod® 4L and Ramrod® 20G, respectively. Hydroxy-propachlor remained in the 0-6 inch soil depth. The last detection of this degradate occurred on day 30 and 180 days after application for both plots treated with Ramrod® 4L and Ramrod® 20G, respectively.

Norchloropropachlor and propachlor methylsulfone reached relatively low values through the study (≤ 0.053 ppm). Norchloropropachlor remained in the upper 0-6 inch soil depth. Detections of methylsulfone were reported in the 12-18 inch soil depth on days 180, 364, and 552 after application, averaging 0.010-0.011 ppm.

York, Nebraska

Propachlor (Ramrod® 4L and Ramrod® 20G), applied once at 6 lb a.i./A, dissipated with a registrant-calculated DT_{50} of 5.0-5.8 days and DT_{90} of 16.5-19.1 days from a bareground plot of a loam soil in York, Nebraska. In the 0-6 inch soil depth of the plot treated with Ramrod® 4L, propachlor averaged a maximum of 2.078 ppm on day 3 after application, 1.134 ppm on day 7 after application. In the 0-6 inch soil depth of the plot treated with Ramrod® 20G, propachlor averaged a maximum of 2.314 ppm on day 3 after application, 1.744 ppm on day 7 after application, and 0.145 ppm after application.

Propachlor remained largely in the upper 0-6 inch soil layer. One detection was reported in the 6-12 inch soil layer in the plot treated with Ramrod® 4L, (average 0.048 ppm, day 1 after application). In the plot treated with Ramrod® 20G, detections were reported in the 6-12 inch soil depth from day 0 to day 14 after treatment (0.010-0.046 ppm), and one detection in the 12-18 inch soil depth on day 14 after application (average 0.021 ppm).

The following degradates were monitored in the soil:

Propachlor oxanillic acid was the degradate present at highest concentrations in the soil. It was a maximum of 0.295 and 0.472 ppm on day 21 after application in the fields treated with Ramrod® 4L and Ramrod® 20G, respectively. The degradate remained largely in the 0-6 inch soil depth for both plots. Detections were observed through day 120 after application in both plots.

Propachlor sulfinylacetic acid reached a maximum average of 0.130 ppm on day 14 after application in the plot treated with Ramrod® 4L and 0.188 ppm on day 21 after application in the plot treated with Ramrod® 20g. The degradate remained largely in the 0-6 inch soil depth for both plots. Detections were observed through day 60 after application.

Propachlor sulfonic acid reached a maximum average of 0.178 ppm on day 30 after application in the plot treat with Ramrod® 4L and 0.302 ppm on day 21 after application in the plot treated with Ramrod® 20G. In the plot treated with Ramrod® 4L, the sulfonate remained largely in the 0-6 inch soil depth; detections were reported through 365 days after application. In the plot treated with Ramrod® 20G, there were after application and there was one observation in the 12-18 soil depth (average 0.015 ppm on day 21 after application).

Hydroxypropachlor was a maximum average of 0.016 ppm on day 3 after application in the plot treated with Ramrod® 4L; it was a maximum average of 0.177 ppm on day 7 after application in the plot treated with Ramrod® 20G. In both plots, it appears that the degradate was not very persistent, with detections reported through 30 days after application. In all cases, hydroxypropachlor stayed in the upper 0-6 inch soil layer.

Norchloropropachlor and propachlor methylsulfone were present at relatively low levels (average ≤ 0.078 ppm) through the study in both plots. Norchloropropachlor was detected through day 30 after application and methylsulfone was detected through day 120 after application. All detections occurred in the upper 0-6 inch soil depth.

Uvalde, Texas

Propachlor (Ramrod® 4L and Ramrod® 20G), applied once at 6 lb a.i./A, dissipated with registrant calculated DT_{50} of 2.3-2.8 days and DT_{90} of 7.6-9.1 days from a bareground plot of clay soil in Uvalde, Texas. In both plots, treated with Ramrod® 4L and Ramrod® 20G, propachlor was a maximum on day 0 after application (averages of 2.130 and 3.038 ppm, respectively). By day 8 after application, the level of propachlor had decreased substantially (0.062 and 0.417 ppm). Propachlor remained in the upper 0-6 inch soil layer in both plots, treated with Ramrod® 4L and Ramrod® 20G.

The following degradates were monitored in the soil:

Propachlor oxanilic acid reached a maximum average of 0.452 and 0.668 ppm on day 8 after application in the plots treated with Ramrod® 4L and Ramrod® 20G, respectively. Detections of this degradate were observed through 62 days after application in both plots. Various detections were reported in the 6-12 inch soil layers, and one minor detection averaging 0.012 ppm was observed in the 12-18 inch soil depth on day 16 after application in the plot treated with Ramrod® 20G.

Propachlor sulfonic acid was a maximum average of 0.326 and 0.416 p.m. on day 8 after application for the plots treated with Ramrod® 4L and Ramrod® 20G, respectively. Various detections were reported in the 6-12, 12-18, 18-24 inch soil layers. In the plot treated with Ramrod® 20G, detections in the 24-30 inch were reported on days 16 and 62 days after application. Additionally on day 62 after application, a minor detection averaging 0.014 p.m. was reported in the 30-36 inch soil depth in the plot treated with Ramrod® 20G. The majority of the detections were observed prior to or on day 62 after application.

Hydroxypropachlor was a maximum average of 0.206 p.m. on day 0 after application in the plot treated with Ramrod® 4L; it was maximum average of 0.180 p.m. on day 3 after application in the plot treated with Ramrod® 20G. All the detections of hydroxypropachlor were confined to the upper 0-6 inch soil layer in both plots. All detections on day 16 after application and thereafter were ≤ 0.023 p.m.

Norchloropropachlor was a maximum on day 8 after application for both plots, treated with Ramrod® 4L and Ramrod® 20G, with averages of 0.104 and 0.101 p.m., respectively. Norchloropropachlor was largely confined to the upper 0-6 inch; however, detections averaging ≤ 0.019 p.m. were reported on days 16 and 31 in the 6-12 inch layer of the plot treated with Ramrod® 4L, and on day 8 (12-18 inch soil layer and 16 (6-12 inch soil layer) of the plot treated with Ramrod® 20G.

Propachlor methylsulfone was ≤ 0.046 p.m. at all test intervals and was observed in the 0-6 and 6-12 inch soil layer through day 365 after application.

f. Bioaccumulation

164-4 Bioaccumulation in Fish (MRID# 42711801)

This study is acceptable and can be used to satisfy the Bioaccumulation in Fish data requirement. No additional data are required.

Propachlor residues accumulated in bluegill sunfish that were continuously exposed to [¹⁴C]-propachlor, at 14 µg/L. The maximum bioconcentration factors observed were 13X for edible tissues, 17X for nonedible tissues, and 37X for the whole fish. By day 3 of the depuration period, 84% of the accumulated residues had been eliminated from the whole fish. Two major propachlor degradates were identified in the edible and nonedible tissues:

Cysteine conjugate was 47.7-64.9% of the [¹⁴C] residues in the edible tissue, and 24.9-29.6% of the recovered in the nonedible tissues.

Mercapturic acid conjugate was 6.2-7.2% of the [¹⁴C] residues in the edible tissue, and 59.5-62.3% of the [¹⁴C] residues recovered in the nonedible fish tissues.

g. Water Resource Assessment

i. Ground Water Assessment

Based on the laboratory and field studies conducted, it appears that parent propachlor does not pose a significant threat to ground-water quality under most conditions. The chemical has a high mobility ($K_{ads}=0.45-1.39$) but is susceptible to aerobic soil metabolism ($t_{1/2}<3$ days; $DT_{50}\sim 5$ days). The terrestrial field dissipation studies also suggest that propachlor does not persist long enough to exhibit substantial leaching (DT_{50} 1-7 days). However, the three acidic degradates have a high potential to leach to and persist in ground water.

Ground-water monitoring data collected and reported to the STORET system on the occurrence of propachlor between 1980 and 1997 indicates its presence in ground water in association with known use areas. Concentrations above the level of quantification were reported for 10 samples; the maximum being 0.17 ppb. More than 7500 samples) or below the level of detection (LOD) which ranged from 0.004-0.012 ug/L (ca. 25 percent of 7500 samples). A substantial number of the sample could not be correlated that sampling occurred in known use areas.

The data collected on the occurrence of propachlor in ground water may represent both the parent and its degradates. The analytical procedures used in several of the studies, where the authors could be contacted, indicated that it wasn't possible to distinguish between the parent and several of the more mobile and structurally similar degradates or the results were reported as both the parent and known degradates. Therefore, it is possible that concentrations reported to STORET include both the parent and /or several of the closely related degradates.

Ground-water monitoring data from the EPA's Pesticides in Ground Water Database reported samples collected over 6 years in 11 states representing 2718 samples.

Concentrations above the LOD were reported in 33 of the wells in 5 states as 0.02 to 3.5 ppb. Positive results were obtained in several of the major corn and sorghum growing regions. As indicated above, the uncertainty of the report values as parent, parent and degradate, or degradate applies to these data as well.

Three acidic degradates of propachlor (propachlor oxanilic acid, propachlor sulfonic acid and propachlor sulfinyl acetic acid) were observed both in the aerobic soil metabolism and the terrestrial field dissipation studies. In the laboratory, under aerobic soil metabolism conditions, it appeared that propachlor oxanilic acid and propachlor sulfonic acid were persistent. In the field, the three degradates appeared to persist and leach substantially (to a 36-42 inch soil depth).

ii. Surface Water Assessment

Propachlor can contaminate surface water via runoff if runoff-producing rain events occur within the first few days to weeks post application. A very low soil/water partitioning of propachlor ($K_{ads}=0.45-1.39$), and its solubility in water (613 p.m.) suggest that propachlor will primarily move via dissolution in runoff water (as opposed to adsorption to eroding soil). It appears that the persistence of propachlor in surface waters with high microbiological activities may be limited by its susceptibility to biodegradation. In waters with short hydrological residence times, its persistence is limited by flow out of the system. However, its resistance to abiotic hydrolysis and photolysis, coupled with its low volatilization potential (vapor pressure 7.9×10^{-15} mm Hg, calculated Henry's law constant 3.59×10^{-8} atm m³/mol) should make it more persistent in waters with low microbiological activities and long hydrological residence times (e.g., lakes and reservoirs).

Surface water monitoring data collected and reported to the STORET on the occurrence of propachlor between 1978 and 1997 indicates its presence in surface water in association with known use areas. Concentrations above the LOQ were reported for approximately 295 samples; the maximum being 10 ppb. More than 16,00 samples were reported as either below the LOQ (ca. 95 percent of samples) or below the LOD (ca. 5 percent of samples). The LOQs ranged from 0.001 to 1.3 ppb and LODs ranged from 0.002 to 0.5 ppb. Sample locations were dominated by streams, lakes, and reservoirs. No association with drinking water intakes could be confirmed for the sample sets.

The data collected on the occurrence of propachlor in surface water may represent both the parent and its degradates. The analytical procedures used in several of the studies, where the authors could be contacted, indicated that it wasn't possible to distinguish between the parent and several of the more mobile and structurally similar degradates or the results were reported as both the parent and known degradates. Therefore, it is possible that concentrations reported to STORET include both the parent and/or several of the related degradates.

The major acid degradates of propachlor in the aerobic soil metabolism study were propachlor oxanilic acid, propachlor sulfonic acid, and propachlor sulfinylacetic acid. Even though complete data are not available to fully assess the fate of such degradates, based on the low adsorption coefficient for propachlor oxanilic acid and propachlor sulfonic acid ($K_{ads} \leq 0.08$), it appears that such degradates are only weakly adsorbed to soil surfaces. Based on the results

of the aerobic soil metabolism and the terrestrial field dissipation studies, it appears that these major degradates may be available for runoff longer than parent propachlor and will probably runoff primarily by dissolution in runoff water. Available metabolism studies suggest that these degradates may also persist longer in surface waters as well.

h. Aquatic Exposure Assessment

Preliminary aquatic EECs are estimated using GENEEC, a screening model that provides an upper-bound estimate of EECs on a high exposure site. The GENEEC program uses basic environmental fate values (adsorption to soil, degradation in soil before runoff and in water) and pesticide label information (rates, intervals, incorporation, method of application) to estimate the EECs in a one-hectare, two-meter deep pond following the treatment of a 10 hectare field. The runoff event occurs two days after the last application. The model accounts for direct deposition of spray drift onto the water body (assuming 5% of the application rate for aerial spray applications and 1% for ground spray applications). When risk quotients (RQs) for aquatic organisms are exceeded, refined aquatic EECs are calculated using PRZM/EXAMS.

Table 2: Environmental fate parameters used to predict propachlor ECCS.

Parameter	Value
Water solubility (p.m.)	613 p.m.
K.C.:	112
aerobic soil metabolism, t1/2:	
8.1 days ¹	
hydrolysis t1/2, pH 7:	Stable
aerobic aquatic metabolism, t1/2:	Not
available	
aqueous Photolysis t1/2:	Stable

¹The calculated aerobic soil metabolism half-life was 2.7 days. The value was multiplied by a factor of 3 to account for variability with such studies and the absence of more than one study.

The Pesticide Root Zone Model (PRZM3.12) simulates pesticides in field runoff on daily time steps, incorporating runoff, infiltration, erosion, and evapotranspiration. The model calculates foliar dissipation and runoff, pesticide uptake by plants, microbial transformation, volatilization, and soil dispersion and retardation. the Exposure Analysis Modeling System (EXAMS 2.975) simulates pesticide fate and transport in an aquatic environment (one hectare body of water, two meters deep).

Table 3: Estimated Environmental Concentrations (ECCS) For Aquatic Exposure from Aerial Application on Selected Uses Using GENIC and PRZM/EXAMS.

Site	Application Rate x No/ Interval (da)	-----Estimated Environmental Concentrations (ECCS), Ug/1 -----						
		Peak	4-day	21- day	56/60- day	90-day	long-term Avg	
Tier 1: GENIC								
Corn / Sorghum	3.0 x 1	101		100	99	97	--	--
	6.0 X 1	202		201	199	193	--	--
Tier 2: PRZM3.12/EXAMS 2.75 in 10 year ECCS								
Corn	6.0 x 1	44.0	35.6	16.3	6.4	4.3		0.5
Sorghum	6.0 x 1	64.0	46.7	19.1	7.6	5.1		0.6

i. Estimated Water Concentration For Drinking Water

The estimated concentrations provided below for drinking water are for the parent propachlor only. If degradates are included in the tolerance expression, then it may be necessary to re-evaluate monitoring data to determine its usefulness in a risk assessment.

i. Ground Water Sources

The preliminary ground water assessment was made using SCI-GROW² to estimate the “maximum” ground-water concentration from the application of a pesticide to crops. SCI-GROW is based on the fate properties of the ground-water monitoring studies. The model assumes that the pesticide is applied at its maximum rate in areas where the ground water is particularly vulnerable to contamination. In most cases, a considerable portion of any use area will have ground water that is less vulnerable to contamination than the areas used to derive the SCI-GROW estimates. As such, the estimated “maximum” concentration derived using SCI-GROW should be considered a high-end to bounding estimate of “acute” exposure. The concentration for parent propachlor estimated using SCI-GROW is approximately 1.0 ppd. The results of this model should be compared to available monitoring data when potential for human exposure.

² Barrett, M. 1997. SCI-GROW; “A proposed method to determine screening concentrations estimates for drinking water from ground water sources. “ Draft. USEPA/OPP/EFED, September 1997.

ii. Surface Water Sources

Tier II surface water drinking water ECCS were calculated using PRZM2.3 to simulate the

agricultural field Exams II for fate transport in surface water. Spray drift was simulated using the assumption that 1% of applied propachlor reached surface water at the time of application and 95% of the chemical deposited on the target site. The remaining 4% either remained airborne or deposited on the ground beyond the drainage basin for the pond.

Environmental fate parameters used to predict propachlor ECCS were presented in Table 2. The scenario chosen for propachlor were a corn field in Pottawattamie County, Iowa and a sorghum field in Neosho County, Kansas. Scenarios were chosen to represent sites that were expected to produce runoff greater than 90% of the sites where the appropriate. Tier II one-in-ten year (upper tenth percentile) ECCS are presented in Table 3. The ECCS have been calculated so that in any given year, there is a 10% probability that the maximum average concentration of that duration in that year will equal or exceed the EEC at the site.

The overall upper 90% confidence bound on the mean concentrations of propachlor were 0.5 ug/1 from the application to corn, and 0.6 ug/1 from the application to grain sorghum. These upper 90% confidence bounds are the best value to use in cancer risk assessments as they are the best estimate of lifetime mean concentrations. The maximum 1 in 10 year concentration to grain sorghum. These values are the suggested value for use in acute risk assessments

iii. Use of Screening Estimates for Drinking Water Assessments

EFED recommends that the ECCS generate from SCI-GROW (for ground water sources) and from PRZM/EXAMS (for surface water sources) be used for drinking water risk assessments for the parent propachlor. The monitoring data reported here are not considered reliable for use in drinking water assessments because they were not well correlated with the use patterns for propachlor or to drinking water intakes. The model predictions provide a screen to eliminate those chemicals that are not likely to cause drinking water problems. Exceedances in drinking water risk assessments using the screening model estimates do not necessarily mean a problem actually exists but point to the need for better data (such as monitoring studies specifically designed to relate water concentrations usage) on which to make a decision. It is possible that the additional data will show no problem; it is also possible that the data will show that in additional data will show no problem; it is also possible that the data will show that in some instances a problem may still exist. If degradates are to be included in the tolerance expression, the monitoring data may have to be re-evaluated for usefulness and/or the modeling data will have to be re-calculated to include the appropriate degradates.